AMENDMENTS TO THE DRAWINGS

Proposed drawing changes are shown on the attached annotated marked up drawings and are incorporated with the attached proposed replacement sheets of drawings.

Attachment: Replacement Sheet(s) – two (2) (Figures 4B and 8)
Annotated Sheet Showing Changes (Figures 4B and 8)

REMARKS/ARGUMENTS

Reconsideration of this application is respectfully requested.

In response to the drawing objection, *vis-à-vis* Figure 8, suitable correction has been made as attached, this obviating this objection.

Fig. 4B has been amended to correct a clerical error whereby a map data identifier in step 2400 is indicated as "U1" (indicating fixed-point data) instead of "PL" (indicating floating—point data). As described in lines 9-11 of the specification, referring to Fig. 4B: "If it is judged in step 2400 that the ID data do not indicate that the map values are expressed by floating-point representation data, then step 2500 is executed,..."

In response to the formality-based objections to claims 5, 8 and 13, these claims have also been amended so as to obviate the Examiner's stated ground for objection.

In this respect, it is noted that independent claim 1 now defines the acronym "LSB" so that it is believed to be permissible then in dependent claims to simply refer to the acronym "LSB." Independent claim 13 has been similarly amended so as to define the acronym "LSB."

In response to the rejection of claims 1-16 under 35 U.S.C. §101, each of the independent claims have been amended so as to also require outputting a calculated value representing the physical quantity. Accordingly, even within current U.S. Patent and Trademark Office guidelines, it is believed that these claims now definitely provide a practical/physical application or a concrete, useful and tangible result in full compliance with 35 U.S.C. § 101.

The rejection of claims 1-5, 8, 11 and 13 under 35 U.S.C. § 103 as allegedly being made "obvious" based on applicant's "admitted prior art" in view of Hinds '331 is respectfully traversed.

Some advantages provided by the invention can be summarized as follows. Take the case of interpolation between a pair of numeric values that are stored in a memory as respective fixed-point numbers (e.g., any adjacent pair of the "remaining fuel amount" values shown in Fig. 2A of the drawings). As described, such storing of numeric values in fixed-point representation rather than floating-point representation has the advantage of a smaller amount of data being stored (each numeric value is expressed by a smaller number of bits than would be the case with floating-point representation). However in order to obtain sufficient accuracy when performing arithmetic operations on such fixed-point representation numeric values, it is preferable to convert them to floating-point representation.

In the prior art, when such stored fixed-point representation numeric values indirectly represent respective values of a physical quantity (e.g., values of fuel amount, as with the map values of the described exemplary embodiment are utilized, the following operations are performed in an interpolation calculation using a pair of these stored numeric values. In addition to converting each of the numeric values to floating-point representation, each is also converted to directly represent a value of the physical quantity. An interpolation calculation is then performed, with the result being a floating-point value result that directly represents the required interpolated value of the physical quantity.

With such a prior art method, a substantial amount of processing is required for separately converting each of the numeric values to directly represent a value of the physical quantity, before performing interpolation. This is a disadvantage which is substantially reduced with the present invention as described in paragraph (3) on page 28 and paragraph (5) on pages 28-29 of the specification.

Specifically, in the case of the present exemplary embodiment, when, for example, a calculation operation such as an interpolation is to be performed on a pair of values selected from a set of fixed-point numeric values, such as the set of map values representing "remaining fuel amount" values in Fig.2A of the drawings, only the following processing sequence is required:

(1) the two fixed-point values are first each converted to floating-point representation,

(2) the calculation is performed on the resultant floating-point representation values, to obtain a result (interpolated value) in floating-point representation, and

(3) the result is then multiplied by a "LSB conversion value" (a floating-point numeric value), to convert the result to a floating-point number that directly represents the required interpolated value of the physical quantity.

The LSB conversion value is predetermined as directly representing a physical quantity value that corresponds to the LSB (least significant bit) of the set of fixed-point numeric values (e.g., the LSB of each of the map values in Fig. 2A)

As described on page 14 of the specification, for example, the LSB conversion value corresponding to the map values of Fig. 2A is 0.4 (if expressed in decimal representation), representing 0.4 liters of fuel. Hence in this case, each of the map values ("remaining fuel amount values"), or a value obtained by interpolation between a pair of the map values, can be converted to the equivalent fuel amount simply by multiplying by 0.4 (with the multiplication operation being performed on floating-point representation values).

It can thus be understood that the present invention enables a substantial reduction in the amount of processing required to obtain a direct value of a physical quantity when using map data that indirectly represent values of the physical quantity and that are stored as fixed-point values.

Claim 1 has been amended to recite this feature of the invention in more detail (similar to original claim 5).

Claim 1 has also been amended in view of the rejection under 35 U.S.C. § 101, to specify that the conversion means performs the described operations as part of its processing for converting an input numeric value (e.g., detection voltage value) to a corresponding value of a physical quantity (e.g., fuel amount).

As described above, the claim scope of the present invention is now limited to an apparatus which utilizes map data made up of a set of map points and a corresponding set of map values, with at least one of these two sets consisting of values that indirectly represent respectively corresponding values of a physical quantity.

The admitted prior art is concerned with increasing accuracy of calculations performed using memory map data, by storing and utilizing the map data in floating-point representation rather than in fixed-point representation. Since this is admitted prior art, the present application does not claim any novelty, for the use of such a form of map data.

The Hinds teaching is concerned only with conversion of fixed-point data to floating-point data, and so is unrelated to the features here claimed as novel.

Neither the admitted prior art nor Hinds describes use of a LSB conversion value for operating on map data that indirectly expresses values of a physical quantity to obtain directly expressed values of the physical quantity, as set out in amended claim 1. It is also believed that

the admitted prior art and the Hinds patent, taken separately or together, do not render any of claims 1-5, 8, 11 and 13 obvious.

Claims 2-4, 8 and 11 are each directly or indirectly dependent from claim 1, while claim 13 recites the use of a LSB conversion value, to be utilized as described above.

In rejecting claim 5, the Examiner states that Hinds discloses "means for providing a LSB conversion value that is expressed in floating-point representation and represents a physical quantity value that has been predetermined as corresponding to a least significant bit of fixed-point representation data. As justification, the Examiner states that the LSB conversion value "is a decimal point location within the fixed—point representation." However the objectives of Hinds relate solely to speeding up conversion of fixed-point numbers to floating-point numbers, as is clearly set out, for example, in paragraph [0017] of Hinds: "the inventors have realized a quick and effective technique would be required for converting between a fixed-point representation of a number and a floating-point representation of a number." There is no mention or implication that the techniques described involve applying a LSB conversion value to operate on a floating-point number or on a floating-point representation result of a calculation (e.g., interpolation calculation) performed using floating-point numbers, to obtain a result that directly expresses the value of a physical quantity, as is herein described and claimed.

Manipulation of the decimal point location of a fixed-point number is part of Hinds' techniques for converting between a fixed-point representation and a floating-point representation. This is clearly unrelated to use of an LSB conversion value as now claimed.

Each of Hinds' apparatus claims 2-21 is directly or indirectly dependent from claim 1, which is directed to an apparatus having a data processing unit "to perform a conversion between a fixed-point representation of a number and a floating-point representation of said number".

The rejection of claims 10-12 and 15-16 under 35 U.S.C. §103 as allegedly being made "obvious" based on applicant's "admitted prior art" in view of Hinds and in further view of Ford '698 is also respectfully traversed.

As noted by the Examiner, Ford teaches the use of IDs (identifiers) for map data, for indicating whether map points or map values of map data are in floating-point representation or in fixed-point representation. However, such use of identifiers is not claimed as being novel.

Two prior art patents cited against the Japanese counterpart application are Japanese patent publication No. 2002-008060 (Saito-corresponding to U.S. Patent No. 6,873,324-already cited in this record), and Japanese patent publication No. 2002-157004 (specified in a prior IDS filed herein).

Saito is concerned with a data processing method and apparatus for reducing the amount of data required to be stored for representing a 3-dimensional shape by vertex coordinate data of a plurality of polygons that approximate the shape. The method is based on dividing the vertexes into a plurality of sets, assigning a reference point for each of the sets, and expressing the position of each vertex as an integer value that represents the difference between the coordinates of the vertex and the coordinates of the corresponding reference point as a value relative to a predetermined scale value. The scale value is not related to an LSB conversion value as herein claimed, and remaining features of document 1 are also unrelated to the presently claimed invention.

JP '004 is basically concerned with reducing the amount of data that must be stored as a memory map, by deriving output values from the map values of the map data by performing interpolation of map values. There is no description of utilizing an LSB conversion value which is a single predetermined floating-point representation value, to operate on floating-point

representation map data as herein described. Remaining features of ~~Abe~~ Saito are also unrelated to the presently claimed invention.

Accordingly, this entire application is now believed to be in allowable form and a formal notice to that effect is respectfully solicited.

Respectfully submitted,

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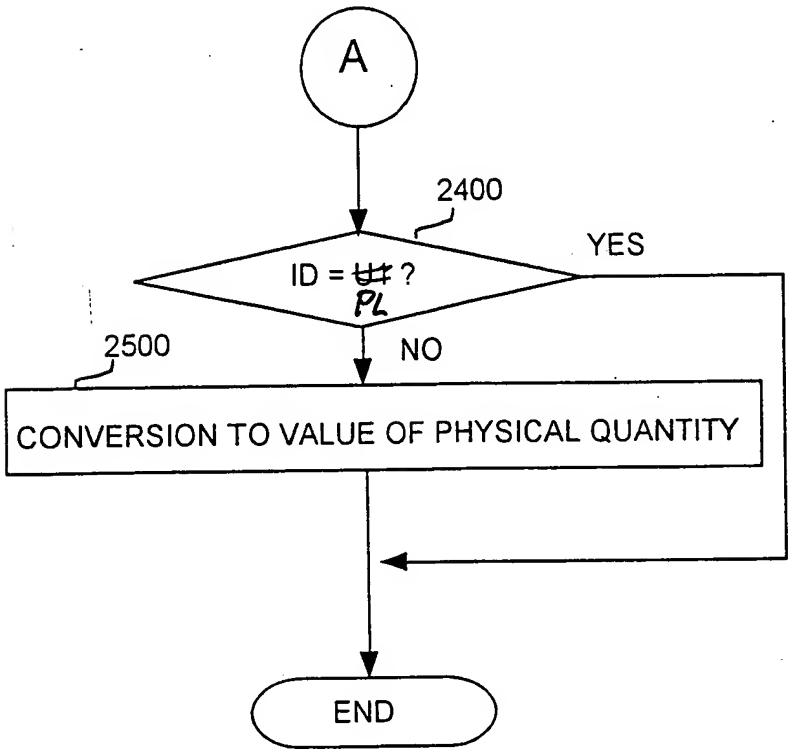
FIG. 4B



ANNOTATED MARKED UP DRAWINGS
FOR SN 10/764,583

FIG. 7

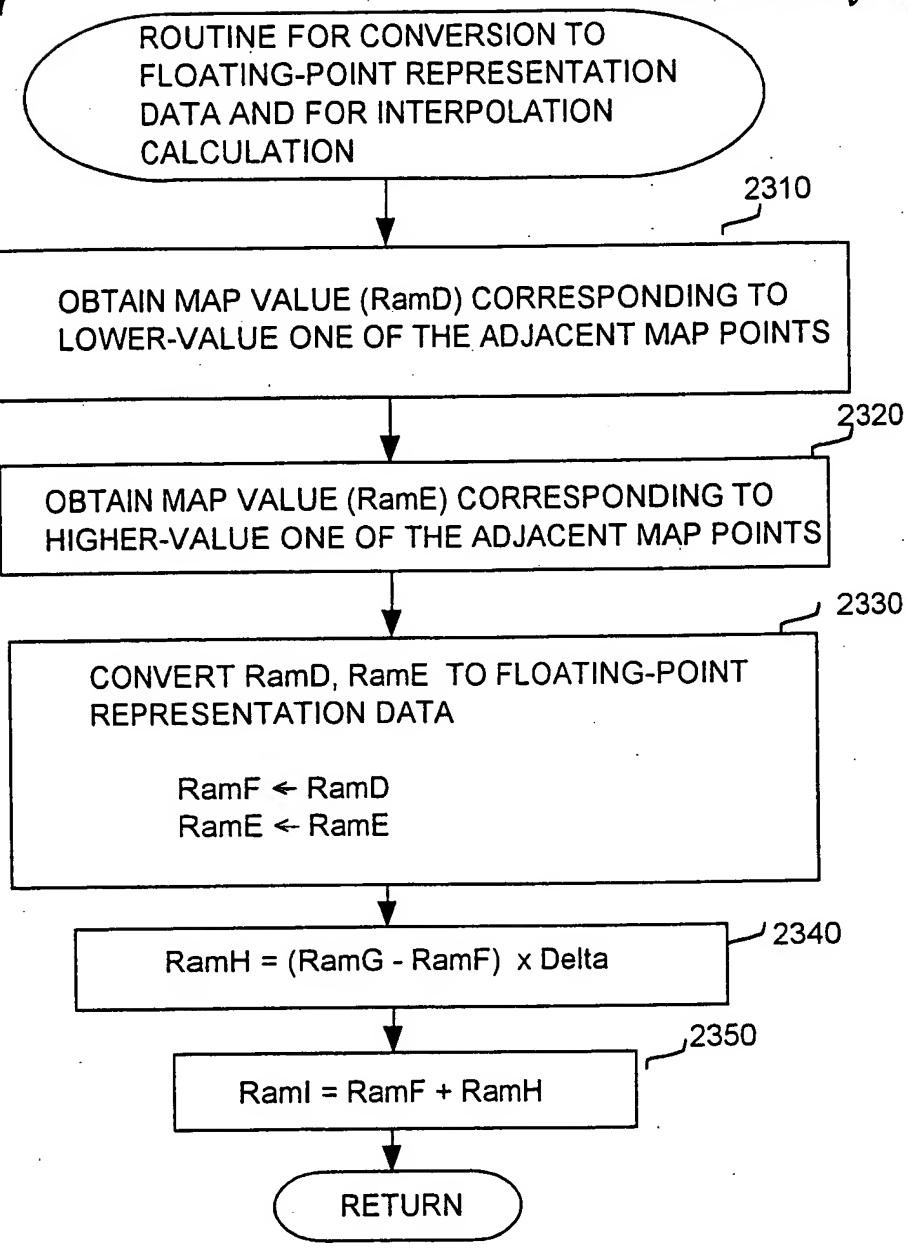


FIG. 8
(PRIOR ART)